Conservation Paleobiology Network

Webinar # 1 An Introduction to Conservation Paleobiology

Visit, calculate, listen, read

1. Visit

Do some virtual field work on the Colorado River Delta
https://prezi.com/5qhsb2l-yahc/webinar-version_colorado-river-delta-vfe/?token=e107e178586411d3bf53e6b15c840416b017643e896ce8c668c57cdec3789ee2&utm _campaign=share&utm_medium=copy

2. Calculate

Activity 2: Estimating Population Density

Background

In this exercise, you will use a quantitative method to estimate the ecological responses of species to changes in their environment. Skeletal accumulations are one of the raw materials used in conservation paleobiology and you will be using the bivalve shell accumulations in the Colorado River Delta. You will estimate the population density of the shells accumulated before upstream water diversions and compare the value with the population density today. This is a measure of the human impact on the delta's productivity.

Learning Objectives & Outcomes

- Estimate population density using bivalve shell accumulations
- Compare the population density of before and after the water diversions

Instruction

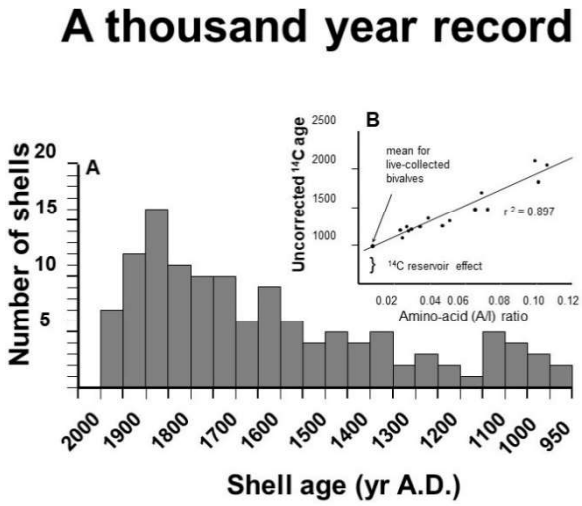
Part I. Calculating total number of bivalves

Using satellite imagery, aerial photos (left) and boreholes of the Colorado River Delta in the Gulf of California, the volume of beach ridges where shells are accumulated was determined as 2.4×10^7 m^3. The density of shells was determined as $17.4 \times 10^4/m^3$ by counting shells that are larger than 12.5 mm in several buckets of shells in the field. Each bivalve has two shells therefore density of bivalves is $8.7 \times 10^4 m^3$.

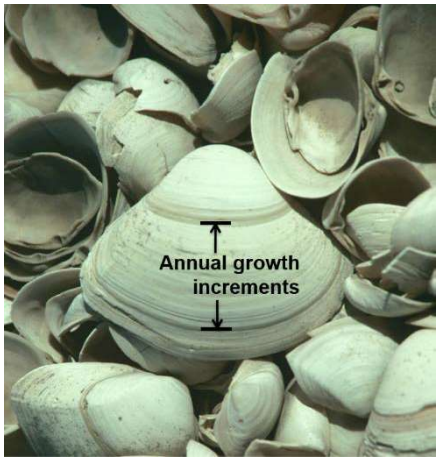
Q1. Using the above information, calculate the density of bivalves in the study area. [Note: Each bivalve has two shells.]

Q2. What is the total number of bivalves in the shelly deposit?

Part II. Estimating average standing population



Radiocarbon dating and amino acid racemization (left) indicate that the age range of the accumulated shells was 1,000 years.



The growth lines in average-sized shells (right) indicate an average age of three years.

Q3. Using the above information and estimates from Part I, estimate the number of bivalve generations in the shelly deposit.

Q4. What is the number of individuals alive at any one time (the "standing population size")?

Part III. Calculating average population density

Today, these bivalves live in the intertidal and shallow subtidal zones. Using satellite imagery (left) and aerial photos of the Colorado River Delta in the Gulf of California, the calculated **area of intertidal zone is 1.2 x 10^8 m^2** .

Make one estimate using **1.2 x 10^8 m^2** as an estimate of habitable area

Assuming the same area of the shallow subtidal zone, now use **2.4 x 10^8 m^2** as an estimate pf the total area once inhabited by these bivalves

Q5. Using the above information and values from Part II, estimate the population density of bivalves in the time before upstream water diversions.

The **average population density** of bivalves in the study area **today** is **2.3 – 3.8** bivalves per square meter (ind/m^2) for shells that are larger than 12.5 mm in size.

Q5. Using the above information and the estimates from question 5, estimate the maximum and minimum changes in the population density since the upstream water diversions.

Citation: Kowalewski, M., Avila Serrano, G.E., Flessa, K.W. and Goodfriend, G.A., 2000. Dead delta's former productivity: Two trillion shells at the mouth of the Colorado River. Geology, 28: 1059-1062. https://doi.org/10.1130/0091-7613(2000)28<1059:DDFPTT>2.0.CO;2

3. Listen

To an indigenous voice from the Colorado Delta
https://www.youtube.com/watch?v=U39L2iTKGSE&feature=youtu.be

4. Read

It takes more than water: Restoring the Colorado River Delta
https://doi.org/10.1016/j.ecoleng.2017.05.028 - the following article
Note: the article was published before approval of Minute 323 to the U.S. Mexico Water Treaty. Minute 323 continues environmental flows until 2026.